

CONCLUSION OF THE WORKSHOP

based on summaries prepared by leaders of the working groups.

Jan Květ

The **Ramsar Convention** (Article 3.2) requires that the basic ecological character of wetlands listed under the Convention must be maintained. If this character has changed, is changing or is likely to change, the respective Contracting Party is obliged to inform the Ramsar Bureau and the significance of the change must be assessed so that appropriate practical counter-measures can be adopted, if necessary. No technical guidelines for this assessment have yet been elaborated although they are badly needed.

Sufficiently precise, firm and hence applicable guidelines must relate the change in ecological character of a wetland to its baseline characteristics employing a carefully selected, small set of essential parameters (comprising the basic hydrological and water-quality features and other abiotic factors, biological characteristics, and information on both present and anticipated uses and management of the wetland concerned). Data sheets containing the above information must be elaborated for all Ramsar sites, and should also be used for other wetlands (of national, regional or local importance). This information should be compatible between the Ramsar sites and other wetlands, as well as with other relevant data sets. Such datasheets must be regularly updated, as should national wetland inventories.

The significance of any ecological change thus assessed should be evaluated on the basis of a comparison of the data obtained by the monitoring with the baseline characteristics of the wetland concerned. The data obtained by the monitoring ought to be summarised and evaluated so as to be useful for management of the wetland(s).

Therefore, expert evaluations of the significance of the ecological changes assessed and of the underlying socio-economic causes are required.

Monitoring of wetlands should cover both apparent and underlying, actual or potential causes of changes in ecological character. Time constraints must be respected when early warning is required and corresponding monitoring techniques are used.

The principal apparent reasons for ecological changes in Central European wetlands have been identified and classified according to their significance as follows:

- drainage of wetlands;
- eutrophication and pollution of wetlands;
- unsuitable forestry and agricultural management of the catchments;
- canalisation, leading to an increase in water discharge.

Approaches to monitoring can differ widely, but they should cover three phases of the processes leading to, or linked with, changes in the ecological character of wetlands:

Phase 1: the policy planning phase (also including financial policy); this planning process should be monitored and early counter-measures adopted to avoid adverse impacts on wetlands, when necessary.

Phase 2: the implementation phase; this is accomplished by on-site monitoring of causes and spatial and temporal patterns of ecological changes, and by an evaluation of the data obtained.

Phase 3: the post-implementation phase; this is accomplished by monitoring the effects of the changes in the ecological character of the wetland(s) concerned as well as of the effectiveness of the monitoring and of any counter-measures taken in phases 1 and 2. The effectiveness of rehabilitation measures undertaken to mitigate undesirable ecological changes should also be monitored in this phase.

Two main problems are likely to be met when implementing phase 1:

- lack of available qualified personnel to monitor policy planning;
- incomplete access to the information needed.

In phase 2, the on-site monitoring should link up with routine wetland surveys, should augment the information from these surveys, and the evaluation of all information obtained should be transmitted without delay to the relevant decision-makers and managers. The methods of evaluating the data obtained by monitoring, and statistical treatment of the data must be determined before the monitoring is put into operation. On the other hand, any development scheme affecting wetlands (especially if financed from public sources) requires monitoring, as an integral part of the whole project, throughout all phases of planning and implementation.

Monitoring of incipient ecological changes in wetlands is needed to provide an early warning system for the decision-making and management sphere. The detection of incipient changes requires a range of special monitoring techniques with rapid production of data at a high level of resolution. The biological techniques used for this purpose employ organisms showing a rapid response to stressors.

Training for monitoring ecological changes in wetlands is required in order to develop the following components of the monitoring and its adaptation to Central European

natural and socio-economic conditions and political systems:

- lobbying and advocacy techniques for influencing policy towards wetlands;
- policy analysis and evaluation of its results. Civil servants should be instructed on the use of the information provided by monitoring ecological changes in wetlands;
- integration, statistical treatment and interpretation of data obtained by monitoring techniques and evaluation procedures (in several languages).

Hitherto, only very few monitoring programmes as such have been accomplished or started in Central European wetlands, and the existing time series of systematically collected data have been obtained during the implementation of various medium-term or long-term research projects or surveys.

While all the above considerations apply to the monitoring of changes in ecological character in any wetlands of Central Europe, the peculiarities of monitoring these changes in particular wetland types have also been considered.

Three broadly conceived wetland types have received special attention: lentic wetlands (shallow lakes, ponds and lake littorals), mires (bogs and fens) and lotic (riverine) wetlands (floodplains), each by a separate working group. The openness and connectivity of these three wetland types increases from the mires, among which especially raised bogs may often be regarded as island ecosystems hosting relic biota, through the lentic to the lotic wetlands. The scope of ecological parameters and interactions to be monitored increases in this order if monitoring is to yield meaningful results. The resilience of these wetland types also increases in parallel.

LAKES AND FISHPONDS

Monitoring of lentic wetlands should concentrate on long-term changes in their ecological character, as short-term changes may be only transient fluctuations. A large number of these wetlands may be monitored sufficiently reliably at one-year intervals for selected key parameters, while a few ponds and carefully selected typical shallow lakes should be monitored at a high frequency throughout the year to provide a solid reference basis. A wide range of parameters can be monitored, and the selection of those to be monitored at any particular site will depend on the kind of ecological change encountered there. Data on fish stocks and fish catches are usually good indicators of the state of lakes and ponds, but the selection of any of these indicators has to be done cautiously. Waterbirds are essential and noteworthy constituents of lentic wetland ecosystems, but in most cases their populations do not represent a useful monitoring tool.

MIRES

In mires, monitoring of their past development is possible on the basis of macrofossil and pollen analysis. Mires themselves thus serve as recording devices. A relatively large number of Central European mires, namely bogs, has remained in a near-natural state. It is possible to use them as standards against which changes in ecological character, or the success of rehabilitation measures in any particular bog can be measured. At the same time, mires are highly fragile ecosystems hosting specialised biota, and monitoring should aim at distinguishing ecological change caused by local impacts from that caused by global impacts. Structural changes in bog ecosystems can be monitored relatively easily and they indicate profound functional changes. Disturbances caused by the monitoring itself may be long-lasting and have

to be minimised. Mires have a specific micro and mesoclimate whose slight irreversible changes can induce far-reaching changes in the whole ecosystem, especially in its water budget and community dynamics. Bogs, especially raised ones, are equally sensitive to increased nutrient inputs, even from rain and snowfall. Both the microclimate and nutrient status of bogs must therefore be monitored most carefully. The structure and dynamics of plant and animal species populations can serve as bioindicators of ecological changes caused by changes in abiotic factors.

RIVERINE WETLANDS

The ecological character of lotic (riverine) wetlands exhibits wide natural fluctuations as does that of the diversity of subsystems within any floodplain that is still functional (though most are greatly altered through human impact, both direct and indirect). The monitoring effort should therefore be directed towards distinguishing directional change from natural fluctuations in the ecological character of floodplains, the former change usually being a vector within the changing amplitude of the fluctuations. Many changes observed in the discharge, water quality and sediment deposition in lowland floodplains are caused by changes in the management of headwater areas. The monitoring of riverine wetlands should therefore be performed simultaneously on several scales (usually three: macro, meso and micro) encompassing the whole catchment area, selected river and floodplain segments, and carefully selected transects across the floodplain, respectively. The openness and intrinsic variability of riverine wetlands, including their vulnerability to invasions of alien species, complicates the selection of reliable bioindicators of ecological change. On the other hand, routinely recorded data on water-level fluctuations, river discharge, water quality, and records of waterworks that

changed the ecological character of riverine wetlands in the past, provide good reference points for more sophisticated monitoring.

Further details on the monitoring of ecological change in the above three types of Central European wetlands are given in the conclusions of the working groups.

Address of the author:

Jan Květ

Institute of Botany
Czech Academy of Sciences
CZ-37982 Třeboň
CZECH REPUBLIC